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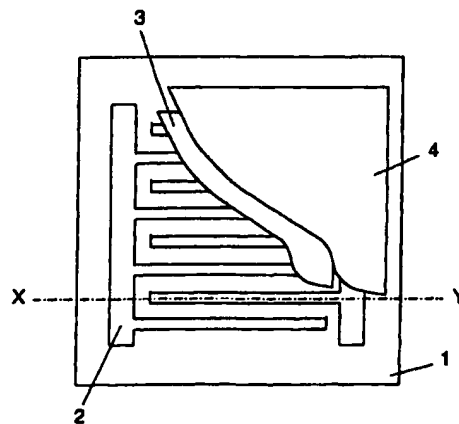
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(54) Title: FLEXIBLE PTC HEATING ELEMENT AND METHOD OF MANUFACTURING THE HEATING ELEMENT

(54) 発明の名称: 柔軟性PTC発熱体とその製造方法



(57) Abstract: A flexible PTC heating element, wherein parts of an electrode and a PTC resistance body are sunk in a flexible base material and the flexible base material is formed of a resin foam body or a rubber material having an irregular shape on the surface thereof, or an extendably deforming part is provided at least on either of the electrode and the PTC resistance body and the flexible base material has an adhesiveness and the flexible base material or a flexible coating material has an extension resisting part, whereby a high flexibility and an excellent durability against excitation can be provided to the flexible PTC heating element.

(57) 要約: 本発明による柔軟性PTC発熱体は、次のいずれかの構成を有する。電極とPTC抵抗体との一部が柔軟性基材に含浸している。柔軟性基材が、表面に凹凸形状を設けた樹脂発泡体またはゴム材からなる。電極とPTC抵抗体とのうち少なくとも一方に設けた伸び変形部を有する。柔軟性基材が接着性を有し、柔軟性基材が柔軟性被覆材が伸び規制部を有する。そのため柔軟性に富み、加振耐久性に優れる。

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NO, NZ, OM, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK,
SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN,
YU, ZA, ZM, ZW.

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ML, MR, NE, SN, TD, TG).

(84) 指定国(広域): ARIPO 特許 (GH, GM, KE, LS, MW, MZ,
SD, SL, SZ, TZ, UG, ZM, ZW), ユーラシア特許 (AM,
AZ, BY, KG, KZ, MD, RU, TJ, TM), ヨーロッパ特許
(AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB,
GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR),

添付公開書類:

— 国際調査報告書

2文字コード及び他の略語については、定期発行される
各PCTガゼットの巻頭に掲載されている「コードと略語
のガイダンスノート」を参照。

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP03/07600

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl⁷ H01C7/02, H05B3/14, 3/34, 3/20

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int.Cl⁷ H01C7/02, H05B3/14, 3/34, 3/20

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Toroku Jitsuyo Shinan Koho 1994-2003
Kokai Jitsuyo Shinan Koho 1971-2003 Jitsuyo Shinan Toroku Koho 1996-2003

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
E,X E,Y	JP 2003-217904 A (Matsushita Electric Industrial Co., Ltd.), 31 July, 2003 (31.07.03), Full text; all drawings (Family: none)	1-5 6-53
E,Y	JP 2003-217902 A (Matsushita Electric Industrial Co., Ltd.), 31 July, 2003 (31.07.03), Full text; all drawings (Family: none)	1-53
P,X P,Y	JP 2003-109804 A (Matsushita Electric Industrial Co., Ltd.), 11 April, 2003 (11.04.03), Full text; all drawings (Family: none)	1-8 9-53

☒ Further documents are listed in the continuation of Box C.

☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier document but published on or after the international filing date
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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search
10 September, 2003 (10.09.03)

Date of mailing of the international search report
24 September, 2003 (24.09.03)

Name and mailing address of the ISA/
Japanese Patent Office

Authorized officer

Facsimile No.

Telephone No.



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP03/07600

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P, Y	JP 2003-217903 A (Matsushita Electric Industrial Co., Ltd.), 11 April, 2003 (11.04.03), Full text; all drawings (Family: none)	1-53
P, Y	JP 2002-270403 A (Matsushita Electric Industrial Co., Ltd.), 20 September, 2002 (20.09.02), Full text; all drawings (Family: none)	1-53
A	WO 00/10177 A (GENERAL ELECTRIC CO.), 24 February, 2000 (24.02.00), Full text; all drawings & US 6133820 A & JP 2002-522916 A	1-53
A	JP 2001-237104 A (NGK Insulators, Ltd.), 31 August, 2001 (31.08.01), Full text; all drawings & EP 1122211 A	1-53
A	JP 2001-326105 A (TDK Corp.), 22 November, 2001 (22.11.01), Full text; all drawings (Family: none)	1-53

A. 発明の属する分野の分類 (国際特許分類 (IPC))

Int. Cl⁷ H01C 7/02, H05B 3/14, 3/34, 3/20

B. 調査を行った分野

調査を行った最小限資料 (国際特許分類 (IPC))

Int. Cl⁷ H01C 7/02, H05B 3/14, 3/34, 3/20

最小限資料以外の資料で調査を行った分野に含まれるもの

日本国実用新案公報 1922-1996年

日本国公開実用新案公報 1971-2003年

日本国登録実用新案公報 1994-2003年

日本国実用新案登録公報 1996-2003年

国際調査で使用した電子データベース (データベースの名称、調査に使用した用語)

C. 関連すると認められる文献

引用文献の カテゴリー*	引用文献名 及び一部の箇所が関連するときは、その関連する箇所の表示	関連する 請求の範囲の番号
EX	J P 2003-217904 A (松下電器産業株式会社) 2	1-5
EY	003. 07. 31, 全文, 全図 (ファミリーなし)	6-53
EY	J P 2003-217902 A (松下電器産業株式会社) 2	1-53
	003. 07. 31, 全文, 全図 (ファミリーなし)	
PX	J P 2003-109804 A (松下電器産業株式会社) 2	1-8
PY	003. 04. 11, 全文, 全図 (ファミリーなし)	9-53

☒ C欄の続きにも文献が列挙されている。☐ パテントファミリーに関する別紙を参照。

* 引用文献のカテゴリー

「A」 特に関連のある文献ではなく、一般的技術水準を示すもの

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「&」 同一パテントファミリー文献

国際調査を完了した日

10. 09. 03

国際調査報告の発送日

24.09.03

国際調査機関の名称及びあて先

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郵便番号100-8915

東京都千代田区霞が関三丁目4番3号

特許庁審査官 (権限のある職員)

重田 尚郎



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電話番号 03-3581-1101 内線 3565

C (続き) . 関連すると認められる文献		
引用文献の カテゴリー*	引用文献名 及び一部の箇所が関連するときは、その関連する箇所の表示	関連する 請求の範囲の番号
PY	JP 2003-217903 A (松下電器産業株式会社) 2003. 04. 11, 全文, 全図 (ファミリーなし)	1-53
PY	JP 2002-270403 A (松下電器産業株式会社) 2002. 09. 20, 全文, 全図 (ファミリーなし)	1-53
A	WO 00/10177 A (GENERAL ELECTRIC COMPANY) 2000. 02. 24, 全文, 全図 & US 6133820 A & JP 2002-522916 A	1-53
A	JP 2001-237104 A (日本碍子株式会社) 2001. 08. 31, 全文, 全図 & EP 1122211 A	1-53
A	JP 2001-326105 A (ティーディーケー株式会社) 2001. 11. 22, 全文, 全図 (ファミリーなし)	1-53

List of Reference Numerals

- 1, 12, 13 flexible base
- 2 comb-shaped electrode
- 3 PTC resistor
- 4, 16, 17 flexible covering
- 5, 7, 9 impregnation adjusted non-woven fabric
- 6 flame resistant non-woven fabric
- 8, 19 hot melt adhesive film
- 10 spunbond
- 11 spunlace
- 14 resin foam
- 15 resin net
- 18 polyester-based non-woven fabric
- 20 uneven texture
- 21 stitched part
- 32, 37, 51A opening
- 36 cross oriented and laminated non-woven fabric
- 2A, 38 main electrode
- 2B, 2C, 39 auxiliary electrode
- 40 conductor wire
- 41 moisture absorbent
- 51, 56 flexible mesh base
- 52 flexible supporting base
- 57 stretch limiting material
- 58 leather
- 59 through-hole
- 66 terminal part
- 67, 71 thin conductive material
- 68 conductive adhesive
- 69 solder
- 69A solder cream pattern
- 70 lead wire
- 72 through-hole
- 82 flexible barrier material
- 86 stretch limiting member
- 87 bonding member
- 88 knit mesh
- 89 cushioned base
- 91 flexible fiber base
- 93 electrode
- 102 flexible base
- 103, 115, 117, 118, 129 fiber base
- 104 film
- 113 irregular region
- 114 hot melt adhesive resin film
- 123 fiber material
- 124 Fibrous PTC resistor
- 125 fiber mesh base
- 142 adhesive resin

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150 fan
151 dehumidifier unit
153 ventilation duct
154 seat
155 pad
156 seat surface
157 perforation
158 flexible PTC heating element
200 base
201, 202 comb-shaped electrode
203 PTC resistor
204 covering

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CLAIMS

1. A flexible PTC heating element comprising:
an electrode formed by printing;
a PTC resistor formed by printing, the PTC resistor being fed from said electrode;
a flexible base into which a part of said electrode and a part of said PTC resistor are impregnated; and
a flexible covering which covers at least said electrode and said PTC resistor, said flexible covering being bonded to said flexible base.
 2. The flexible PTC heating element as claimed in Claim 1, wherein said flexible base includes:
a non-woven fabric; and
an impregnation adjusting material which adjusts the degree of impregnation of a conductive paste forming said electrode and of a PTC ink forming said PTC resistor, into said non-woven fabric.
 3. The flexible PTC heating element as claimed in Claim 2, wherein said impregnation adjusting material is made of either a resin-based coating material or a hot melt adhesive film.
 4. The flexible PTC heating element as claimed in Claim 2, wherein said non-woven fabric is made of a heat resistant fiber that can retain its shape at a melting point of said impregnation adjusting material.
 5. The flexible PTC heating element as claimed in Claim 1, wherein said flexible covering is adherent to at least said flexible base.
 6. The flexible PTC heating element as claimed in Claim 1, comprising uneven texture in cross-section provided over the entire surface thereof.
- The flexible PTC heating element as claimed in Claim 1.
7. The flexible PTC heating element as claimed in Claim 6, wherein said uneven texture in cross-section is formed by either embossing or stitching.
 8. The flexible PTC heating element as claimed in Claim 1, wherein said flexible base has an opening.
 9. The flexible PTC heating element as claimed in Claim 2, wherein said non-woven fabric is a cross oriented and laminated non-woven fabric with continuous fibers being arranged in the direction of stretch of said flexible PTC heating element.
 10. The flexible PTC heating element as claimed in Claim 2, further

comprising a conductor wire incorporated therein at least along the direction of one axis of said non-woven fabric,

said conductor wire serving as a part of said electrode.

11. The flexible PTC heating element as claimed in Claim 1, wherein said flexible base includes either an ink-absorbing flexible mesh base with openings whose shape can be changed or an ink-absorbing flexible fiber base with openings whose shape can be changed.

12. The flexible PTC heating element as claimed in Claim 11, wherein said flexible base is bonded to said flexible mesh base and further comprises a flexible supporting base having ink impermeable characteristics.

13. The flexible PTC heating element as claimed in Claim 11, wherein the openings in either said flexible mesh base or said flexible fiber base are shaped into a diamond form.

14. The flexible PTC heating element as claimed in Claim 11, wherein a cross oriented and laminated non-woven fabric is cut along the bias and used as either said flexible mesh base or said flexible fiber base.

15. The flexible PTC heating element as claimed in Claim 11, wherein said flexible base comprises an ink impermeable flexible barrier material which is impregnated into and held by either said flexible mesh base or said flexible fiber base, in the form of a thin film.

16. The flexible PTC heating element as claimed in Claim 15, wherein said flexible barrier material is made of a hot melt adhesive film and is capable of retaining its shape at a dry temperature of a conductive paste forming said electrode and a PTC ink forming said PTC resistor.

17. The flexible PTC heating element as claimed in Claim 15, further comprising a knit mesh which can be stretched to a limited amount, said knit mesh being bonded between either said flexible mesh base or said flexible fiber base and said flexible barrier material to limit stretch of either said flexible mesh base or said flexible fiber base.

18. The flexible PTC heating element as claimed in Claim 11, wherein at least one of said electrode and said PTC resistor is formed, with the openings in either said flexible mesh base or said flexible fiber base being left, the entire surface being covered with said flexible covering.

19. The flexible PTC heating element as claimed in Claim 1, wherein said flexible base is made of a first fiber base to which a flexible

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resin film is bonded;

said flexible covering is made of a second fiber base to which a hot melt adhesive resin film is bonded, the hot melt adhesive resin film being thermally bondable to either said flexible resin film or said first fiber base.

20. The flexible PTC heating element as claimed in Claim 19, wherein said flexible resin film comprises a thermoplastic elastomer of at least any of olefin-based, urethane-based, and styrene-based one.

21. The flexible PTC heating element as claimed in Claim 20, wherein said flexible resin film further comprises an adhesive resin.

22. The flexible PTC heating element as claimed in Claim 19, wherein said first fiber base and said second fiber base are made of at least either

a non-woven fabric or a first knit having a load of 7.5 kgf or lower for horizontal stretch of 5% and a load of 7.5 kgf or higher for vertical stretch of 5% or

a second knit having a load of 7.5 kgf or lower for both horizontal and vertical stretch of 5%, the second knit having diamond-shaped openings and being capable of stretching by deformation.

23. A flexible PTC heating element comprising:

an electrode formed by printing;

a PTC resistor formed by printing, the PTC resistor being fed from said electrode;

a flexible base made of either a resin foam with an uneven texture in the surface thereof and a rubber material with an uneven texture in the surface thereof, said electrode and said PTC resistor being provided on the surface of the flexible base; and

a flexible covering which covers at least said electrode and said PTC resistor, said flexible covering being bonded to said flexible base.

24. The flexible PTC heating element as claimed in Claim 23, wherein said flexible base further comprises a resin net adhered to either said resin foam or said rubber material.

25. A flexible PTC heating element comprising:

a flexible base having ink impermeable characteristics;

an electrode formed on said flexible base with a conductive paste;

a PTC resistor formed with a PTC ink, the PTC resistor being fed from said electrode;

a flexible covering which covers said electrode and said PTC resistor; and

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a stretchably deformed portion provided in at least one of said electrode and said PTC resistor.

26. The flexible PTC heating element as claimed in Claim 25, wherein said electrode is shaped like a comb with a main electrode and a branch electrode, the branch electrode being electrically connected to said main electrode and said PTC resistor;

said stretchably deformed portion is said branch electrode formed to have a wave shape.

27. The flexible PTC heating element as claimed in Claim 25, wherein said stretchably deformed portion is a PTC resistor fiber obtained by impregnating a stretchable fiber material having openings with said PTC ink, said PTC resistor fiber being used as said PTC resistor.

28. The flexible PTC heating element as claimed in Claim 25, wherein said stretchably deformed portion is a diamond-shaped non-coated portion provided in said PTC resistor.

29. The flexible PTC heating element as claimed in Claim 25, wherein said stretchably deformed portion is said electrode and said PTC resistor which are formed by impregnation into a fiber mesh base having openings.

30. The flexible PTC heating element as claimed in Claim 29, comprising a flexible resin film bonded to the back surface of said fiber mesh base opposite to the surface into which said electrode and said PTC resistor are impregnated.

31. The flexible PTC heating element as claimed in Claim 25, wherein said stretchably deformed portion is said electrode and said PTC resistor formed on the flexible resin film, bonded to the fiber mesh base having openings.

32. The flexible PTC heating element as claimed in any one of Claims 1, 23, and 25 wherein said electrode is shaped like a comb with a main electrode and a branch electrode, the branch electrode being electrically connected to said main electrode and said PTC resistor, and

the flexible PTC heating element further comprising a stretch limit portion which limits stretch in the longitudinal direction of at least said main electrode.

33. The flexible PTC heating element as claimed in Claim 32, wherein said stretch limit portion is made of a knit-like resin net.

34. The flexible PTC heating element as claimed in any one of Claims 1, 23, and 25 comprising a stretch limit portion which limits

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stretch of at least one of said flexible base and said flexible covering.

35. A flexible PTC heating element comprising:
an electrode formed by printing;
a PTC resistor formed by printing, the PTC resistor being fed from said electrode;
a flexible base having said electrode and said PTC resistor formed on the surface thereof, the flexible base having adhesion; and
a flexible covering which covers at least said electrode and said PTC resistor, said flexible covering being bonded to said flexible base;
at least any of said flexible base and said flexible covering having a stretch limit portion.

36. The flexible PTC heating element as claimed in any one of Claims 1, 23, 25, and 35, further comprising a moisture absorbent having an opening;
said moisture absorbent being thermally in contact with said PTC resistor.

37. The flexible PTC heating element as claimed in any one of Claims 1, 23, 25, and 35, wherein said electrode is shaped like a comb with a main electrode and a branch electrode, the branch electrode being electrically connected to said main electrode and said PTC resistor; and
the flexible PTC heating element having stretch of more than 0% and 3% or less at a load of 5 kgf in the longitudinal direction of said main electrode, having stretch of between 3% and 10%, both inclusive, at a load of 5 kgf in the longitudinal direction of said branch electrode, and having a strength at break of 15 kgf or higher.

38. The flexible PTC heating element as claimed in Claim 1, wherein said flexible covering comprises at least any of:
a resin coating material;
a non-woven fabric onto which a hot melt adhesive film is adhered;
a resin foam coated with an adhesive;
a rubber material coated with an adhesive;
a leather; and
an artificial leather.

39. The flexible PTC heating element as claimed in any one of Claims 1, 23, 25, and 35, wherein a through-hole is provided which passes from the back surface to the top surface of a flexible heating element.

40. The flexible PTC heating element as claimed in any one of

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Claims 1, 23, 25, and 35, further comprising a terminal part having one end electrically connected to said electrode and other end electrically connected to a lead wire,
said terminal part being covered with said flexible covering.

41. The flexible PTC heating element as claimed in Claim 40, wherein said terminal part comprises:
a thin conductive material; and
a conductive adhesive material which bonds one end of said thin conductive material and said electrode.

42. The flexible PTC heating element as claimed in Claim 40, further comprising an adhesive non-woven fabric which secures said terminal part, said adhesive non-woven fabric is covered with said flexible covering.

43. The flexible PTC heating element as claimed in Claim 40, wherein said terminal part is provided on the surface of said flexible base, a portion of said electrode being overlapped with one end of said terminal part.

44. The flexible PTC heating element as claimed in Claim 40, wherein said terminal part being disposed within said flexible base, a conductive paste forming said electrode being coated over said flexible base to form a portion of said electrode at one end of said terminal part.

45. The flexible PTC heating element as claimed in Claim 43, comprising a patterned solder cream on said terminal part at the position where said electrode is to be printed.

46. The flexible PTC heating element as claimed in Claim 40, wherein said terminal part comprises a solder untreated portion which electrically connects with said electrode, and a solder treated portion which passes through said flexible covering and connects with a lead wire.

47. The flexible PTC heating element as claimed in any one of Claims 1, 23, 25, and 35, wherein said flexible base includes a first flexible base, and a second flexible base made of a cushioned base, the second flexible base having ink permeable characteristics and capable of dispersing and holding without formation of a thin film;

said PTC resistor being formed on said second flexible base;
said electrode being formed on the first flexible base-like base;

said electrode and said PTC resistor being electrically contacted with each other;

the entire surface being covered with the flexible covering.

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48. The flexible PTC heating element as claimed in any one of Claims 1, 23, 25, and 35, wherein at least one of said electrode and said PTC resistor contains either a resin or an elastomer as a binder.

49. The flexible PTC heating element as claimed in any one of Claims 1, 23, 25, and 35, wherein said electrode contains silver and carbon.

50. The flexible PTC heating element as claimed in any one of Claims 1, 23, 25, and 35, wherein said PTC resistor contains a kneaded and cross-linked product of a crystalline resin and carbon black, and an elastomer.

51. A method for producing a flexible PTC heating element comprising the steps of:

- A) filling a resin at least into openings in a flexible mesh base, the openings being capable of taking different shapes;
- B) forming an electrode and a PTC resistor fed from said electrode by printing on said flexible mesh base;
- C) removing said resin; and
- D) covering the whole with a flexible covering.

52. The method for producing a flexible PTC heating element as claimed in Claim 51, wherein said resin is either water soluble or water decomposable,
water treatment being made at the step C.

53. The method for producing a flexible PTC heating element as claimed in Claim 51, wherein said resin contains either polyvinyl alcohol or carboxymethylcellulose.

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